THE SYSTEMATIC STATUS OF OPPEL'S SPECIMENS OF *BELEMNITES GERARDI*

by G. R. STEVENS

ABSTRACT. Oppel's original specimens of *Belemnites gerardi* from Kalabagh (Punjab) are described and refigured. The name is restricted to the specimens figured as Oppel's pl. 88, figs. 1, 2, and the original of fig. 3 is assigned to a new species, *Belemnopsis uhligi*, based on one of Uhlig's specimens from the Spiti Shales (northern India). Synonymy and diagnoses are provided for *B. gerardi* and *B. uhligi* and their stratigraphic ranges discussed. It is shown that *Belemnopsis kuntkotensis* (Waagen) is a synonym of *B. gerardi* and that the majority of belemnites hitherto assigned to *B. gerardi* should be reassigned to *B. uhligi*.

THE species usually known as *Belemnopsis gerardi* (Oppel), e.g. as interpreted by Uhlig (1903–10, pp. 386–8), is a common belemnite of the Kimeridgian of the Indo-Pacific region, having been recorded from numerous localities in Indonesia (Kruizinga 1921; Stolley 1929, 1934, 1935) and northern India (Oppel 1863; Uhlig 1903–10). Related species have been recorded from East Africa (Tate 1867), northern Australia (Teichert 1940), New Caledonia (Avias 1953), and New Zealand (Marwick 1953).

The name was introduced in 1863 (Oppel 1863, p. 273), but the species was not described and figured until 1865 (Oppel 1865, pp. 296–7). Study of the species has been hampered by lack of adequate figures and descriptions of Oppel's original specimens (1865, pl. 88, figs. 1–3). Through the courtesy of Dr. K. Werner Barthel of the Bayerische Staatssammlung für Paläontologie und historische Geologie, Munich, the writer has been able to examine these specimens.

The species was based on two complete specimens (Oppel 1865, pl. 88, figs. 1, 2), and a third incomplete specimen (fig. 3) which was only tentatively referred to the species by Oppel. All three specimens are preserved in the Schlagintweit Collection in Munich and are labelled '*Macrocephalus*-schichten, Kalabagh im Ob. Punjab'. The accession numbers are as follows: 1872. xv. 502 (Oppel 1865, pl. 88, fig. 1); 1872. xv. 501 (fig. 2); 1872. xv. 46 (fig. 3). Kalabagh (32° 58′ S., 71° 36′ E.) is on the right bank of the Indus, some 70 miles south of Peshawar.

Previous workers have agreed that more than one species is represented by Oppel's specimens, but there has been no agreement on the identity of these species. In 1929 Stolley examined Oppel's specimens, and based his concept of the species (1929, pp. 147, 151) on Oppel's fig. 3 (Oppel 1865, pl. 88). He identified Oppel's fig. 1 as *Belemnopsis aucklandica* (Hauer) (1929, pp. 151, 168) and fig. 2 as *B. alfurica* (Boehm) (op. cit., pp. 151, 172). Spath (1927–33, pp. 661–2) supported Stolley's identification of Oppel's fig. 2 as *B. alfurica*, but did not agree that fig. 1 represents a specimen of *B. aucklandica*. Spath rejected Stolley's choice of the original of Oppel's fig. 3 as the type (properly a lectotype) for *B. gerardi*, as this specimen was only tentatively referred to the species by Oppel. Spath took two of Uhlig's specimens (1903–10, pl. 93, figs. 5, 7) to be typical *B. gerardi* of the Spiti Shales, though Stolley disagreed with this selection (Spath 1927–33, pp. 4, 661). Teichert (1940, p. 114) designated Oppel's fig. 1 as type (lectotype) for

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B. gerardi. This appears to be the first valid selection of lectotype for Oppel's nominal species and is accepted here.

The original of Oppel's pl. 88, fig. 3 (Pl. 98, figs. 9–13; Pl. 99, fig. 4) is a fragment of the alveolar region, 52 mm. in length. Measurements are as follows (in mm.):

Posterior end
Transverse diameter (dt): 21·5 Sagittal diameter (ds): 21·5
Anterior end:
dt: 23·0 ds: 22·0
At the approximate position of the protoconch:
dt: 22·0 ds: 21·5

The guard is massive and non-hastate, with a well-developed ventral groove. The groove is 7 mm. wide where dt = 22·0 mm., and 3 mm. deep where ds = 21·5 mm. Lateral lines and a dorsal groove appear to be absent.

The originals of Oppel's pl. 88, figs. 1 and 2 (Pl. 98, figs. 1–8) are reasonably complete and their measurements (in mm.) are given below (for explanation of abbreviations see Avias 1953, pp. 158–9).

Oppel	*l*	*u*	*v*	*dtM*	*dtm*	*dsM*	*dsm*	*u/v*	*Ht*	*Hs*	*A*	*Rs*
Fig. 1	65	26	39	9·5	8·5	8·5	9·0	0·66	111·7	94·4	111·7	0·27
Fig. 2	72	27	45	11·5	10·5	10·5	11·0	0·6	109·5	95·4	109·5	0·3

In the original of fig. 2 (Pl. 98, figs. 5–8) the guard is elongate and sharply pointed. The outline and profile are symmetrical, and in both the sides gradually taper towards the apex. The outline of the guard is slightly hastate. The ventral groove reaches almost to the apex, and is broad and moderately shallow in relation to the dimensions of the guard. The groove is 1 mm. deep where ds = 10·5 mm., and 3·5 mm. wide where dt = 11·5 mm. Lateral lines are not visible, and a dorsal groove is absent. The cross-section of the guard is depressed in the apical and stem regions, but becomes compressed in the alveolar region.

The original of fig. 1 (Pl. 98, figs. 1–4) is a juvenile and is more hastate than that of fig. 2, but otherwise shows the same characters. Traces of lateral lines are present on the flanks. This specimen appears to have been slightly distorted; the apical region has been bent in a dorsal direction, producing an apparent downwarping of the posterior portion of the guard. Notwithstanding this distortion, it appears that the original specimens of Oppel's figs. 1 and 2 are of the same species, and distinct from Oppel's fig. 3. Boehm (1907, p. 55) refigured the cross-sections of Oppel's pl. 88, fig. 1*c* (ibid., fig. 20), and pl. 88, fig. 3*b*, *c* (ibid., figs. 21*a*, *b*); and as may be seen from these, the cross-section of fig. 1 (compressed) is quite different from that of fig. 3 (circular). The characters of the originals of Oppel's figs. 1 and 2 are identical with those of *Belemnopsis kuntkotensis* (Waagen) recorded from Upper Oxfordian localities in Kachh by Waagen (1873, pp. 3–5) and Spath (1927–33, pp. 8, 9).

Waagen's description of *B. kuntkotensis* applies perfectly to the originals of Oppel's figs. 1 and 2, except that he mentions the presence of a dorsal alveolar groove which cannot be identified in Oppel's specimens because of their incompletely preserved alveolar regions. This feature, however, is usually impersistent in *Belemnopsis* and has no significance (cf. Spath 1927–33, pp. 662–3).

Like many species of *Belemnopsis*, *B. kuntkotensis* becomes less hastate with maturity.

Whereas the juvenile is hastate (as noted by Waagen 1873, p. 4) the adult is almost non-hastate (e.g. Waagen's type of *B. kuntkotensis*; Waagen 1873, pl. 1, figs. 3*a–e*; Spath 1927–33, pl. 1, fig. 1*b*). The type of *B. kuntkotensis* is evidently a more mature stage than the originals of Oppel's figs. 1 and 2, with fig. 2 representing a later stage than fig. 1. In the table below the measurements of the juvenile specimen identified by Spath (1927–33) as *B.* aff. *kuntkotensis* (ibid., pl. 2, fig. 4) are given, along with the measurements of Waagen's holotype, taken from Waagen (1873, p. 4) and Spath's figure (1927–33, pl. 1, fig. 1*b*). The original of Spath's pl. 1, fig. 1*a* (BMNH C19921) is too crushed to provide accurate measurements.

	l	*u*	*v*	*dtM*	*dtm*	*dsM*	*dsm*	*u/v*	*Ht*	*Hs*	*A*	*Rs*	
Spath 1927–33, pl. 2, fig. 4. BMNH, C19943.	46	16	30	8·5	7·0	6·7	7·0	0·53	121·4	95·7	126·8	0·33	Juvenile
Waagen's holotype; measurements taken from Waagen 1873, p. 4, and Spath 1927–33, pl. 1, fig. 1*b*	78	20 Est.	58 Est.	11·5 Est.	11·0	11·0 Est.	12·0	0·34	104·5	91·6	104·5	0·29	

The original of Oppel's fig. 3 conforms in its characters to those of specimens usually identified by previous workers as *Belemnopsis gerardi*. But as fig. 3 is not a specimen in Oppel's type series, its designation by Stolley (1929) as lectotype for *gerardi* is invalid and Teichert's designation (1940, p. 114) of the original of fig. 1 must be accepted. Therefore the name *gerardi* must take precedence over *kuntkotensis* and a new species proposed for belemnites resembling the original of Oppel's fig. 3, previously identified as *B. gerardi*. *Belemnopsis gerardi* is redefined below and a new species, *Belemnopsis uhligi*, proposed.

SYSTEMATIC DESCRIPTIONS

Belemnopsis gerardi (Oppel)

Plate 98, figs. 1–8

1863 *Belemnites gerardi* Oppel, p. 273 (*nom. nudum*).
1865 *Belemnites gerardi* (*partim*) Oppel, pp. 296–7, pl. 88, figs. 1, 2 (*non* fig. 3).
1873 *Belemnites kuntkotensis* Waagen, pp. 3–5, pl. 1, fig. 3.
1879 *Belemnites grantianus* d'Orbigny; Medlicott and Blanford, pl. 12, fig. 2.
1893 *Belemnites grantianus* d'Orbigny; Oldham, pp. 222–4.

EXPLANATION OF PLATE 98

Figs. 1–4. *Belemnopsis gerardi* (Oppel). Lectotype. Upper Jurassic of Kalabagh, Upper Punjab. Accession No. 1872. xv. 502, Schlagintweit Collection, Munich. Original of Oppel 1865, pl. 88, fig. 1. 1, Ventral view. 2, Dorsal view. 3, Left lateral view (i.e. ventral groove facing left). 4, Right lateral view. All ×1.

Figs. 5–8. *Belemnopsis gerardi* (Oppel). Upper Jurassic of Kalabagh, Upper Punjab. Accession No. 1872. xv. 501, Schlagintweit Collection, Munich. Original of Oppel 1865, pl. 88, fig. 2. 5, Ventral view. 6, Dorsal view. 7, Left lateral view. 8, Right lateral view. All ×1.

Figs. 9–13. *Belemnopsis uhligi* sp. nov. Upper Jurassic of Kalabagh, Upper Punjab. Accession No. 1872. xv. 46, Schlagintweit Collection, Munich. Original of Oppel 1865, pl. 88, fig. 3. 9, Cross-section, stem region. 10, Cross-section, alveolar region. 11, Ventral view. 12, Dorsal view. 13, Left lateral view. All ×1. See also Plate 99, fig. 4.

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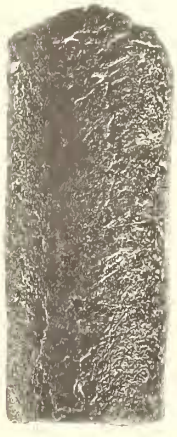

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1907 *Belemnites gerardi* Oppel (*partim*); Boehm, p. 55, fig. 20 (*non* figs. 21*a*, *b*).
1927–33 *Belemnopsis kuntkotensis* (Waagen), *B.* aff. *kuntkotensis*; Spath, pp. 8–9, pl. 1, figs. 1*a*, *b*; pl. 2, fig. 4.
cf. 1929 *Belemnites tanganensis* Futterer; Weir, p. 18, pl. 2, fig. 23; pl. 5, figs. 19, 20.
cf. 1930 *Belemnopsis tanganensis* (Futterer); Weir, p. 90, pl. 10, fig. 3.
cf. 1933 *Belemnopsis tanganensis* (Futterer) (*partim*); Stefanini, pp. 47–50, pl. 4, figs. 3–5 (*non* figs. 2, 6–17).
? cf. 1934 *Belemnopsis tanganensis* (Futterer); Spath, pp. 21, 22.
1935 *Belemnopsis kuntkotensis* (Waagen); Spath, p. 207, pl. 24, fig. 4.
1939 *Belemnopsis gerardi* (Oppel) (*partim*); Spath, pp. 110, 111, pl. 24, fig. 12 (*non* figs. 11, 13).
1951 *Belemnopsis* aff. *kuntkotensis* (Waagen); Nicolaï, pp. 33, 34.
? var. 1953 *Belemnopsis kuntkotensis* (Waagen) var. *puenensis* Avias, pp. 156–7, 164–5, pl. 14, figs. 4, 9, 12, 13, 15; pl. 15, figs. 24, 30, 31, 34, 36–39; pl. 16, figs. 5, 11, 17.
1956 *Belemnopsis kuntkotensis* (Waagen); Hunt, p. 12.
non 1845 *Belemnites grantianus* d'Orbigny, p. 307, pl. 58.
non 1873 *Belemnites gerardi* Oppel; Waagen, pp. 13, 14, pl. 2, fig. 3 (see Spath 1927–33, pl. 1, fig. 3*a*).
non 1894 *Belemnites tanganensis* Futterer, pp. 30–32, pl. 5, figs. 2, 3.
non 1935 *Belemnopsis kuntkotensis* (Waagen); Spath, p. 218 (original of Spath 1927–33, pl. 1, fig. 3*b*).

Diagnosis. A *Belemnopsis* with an elongate and tapering guard. Outline and profile symmetrical, sides and ventral and dorsal surfaces gradually tapering towards the apex. Outline slightly hastate, more so in sub-mature forms. Apex not inflated, tapering. Depressed cross-sections in apical and stem regions, compressed in alveolar region. Ventral groove deep and moderately broad, extending from alveolar region and almost reaching apex. Groove deepest in alveolar region, gradually shallowing towards apex. Poorly developed lateral lines and dorsal alveolar groove may or may not be present.

Lectotype. Original of Oppel 1865, pl. 88, fig. 1, accession number 1872. XV. 502, Schlagintweit Collection, Bayerische Staatssammlung für Paläontologie und historische Geologie, Munich. Designated Teichert 1940, p. 114 (see also Glaessner 1945, p. 155).

Type locality. Kalabagh, Upper Punjab.

Localities and stratigraphic range. Upper Oxfordian–Middle Kimeridgian.

The species occurs in the Punjab (Pakistan) and Kachh (India), Somalia, Madagascar, and probably in Kenya and New Caledonia. In the Kachh sequence it is known from the Kantkot (Kuntkote) Sandstone (Upper Oxfordian) and in Somalia from the lower part of the Daghani Shales (Middle Kimeridgian). The Madagascar and New Caledonia occurrences have been dated as Upper Oxfordian to Lower Kimeridgian.

The precise age of the beds at Kalabagh is unknown. Spath (1927–33, pp. 661–2), influenced by Stolley's work on Indonesian belemnites, favoured an Upper Oxfordian age for *B. gerardi* from Kalabagh. His opinion changed, however, and he later stated (Spath 1939, p. 110; see also 1927–33, p. 802) that there was no evidence for an Upper Oxfordian age for Oppel's specimens of *B. gerardi*, and implied that they came from beds nearly equivalent to the Chidamu Beds of Spiti (i.e. Lower Tithonian).

Both *B. gerardi* (Oppel's figs. 1 and 2) and *B. uhligi* (fig. 3) occur at Kalabagh, but their stratigraphic relationship is unknown. In New Zealand species allied to *B. uhligi* first appear in the Middle Kimeridgian and range up to Lower or Middle Tithonian. Therefore if all three of Oppel's specimens came from approximately the same horizon, a Middle Kimeridgian age is favoured.

Belemnopsis uhligi sp. nov.

Plate 98, figs. 9–13; Plate 99, figs. 1–9

1833 Belemnites; Everest, pl. 1, fig. 17.
1863 *Belemnites sulcatus* Miller; Blanford, p. 125, pl. 1, figs. 1, 2*a–c*.
1865 *Belemnites gerardi* (*partim*) Oppel, pp. 296–7, pl. 88, fig. 3 (*non* figs. 1, 2).
1866 *Belemnites canaliculatus* Schlotheim; Stoliczka, pp. 111–12.
1889 *Belemnites gerardi* Oppel (*partim*); Neumayr, pp. 52–56 (only references to Oppel's fig. 3).
? aff. 1892 *Belemnites gerardi* Oppel (*partim*); Rothpletz, pp. 104–5, pl. 13, fig. 10 (*non* figs. 6–8, 12).
1903–10 *Belemnites* (*Belemnopsis*) *gerardi* Oppel (*partim*); Uhlig, pp. 386–8, pl. 93, figs. 5, 7, 9 (*non* pl. 93, figs. 1, 2, 10–13; pl. 93A, figs. 1, 2, 4, 5).
1907 *Belemnites gerardi* Oppel (*partim*); Boehm, p. 55, figs. 21*a*, *b* (*non* fig. 20).
1920 *Belemnopsis gerardi* (Oppel) (*partim*); Bülow-Trummer, pp. 129–30 (*non* occurrences in S. Africa, N. Alps, and France).
1921 *Belemnopsis gerardi* (Oppel); Kruizinga, pp. 163–6, pl. 1, figs. 1–4; pl. 2, fig. 11.
? 1927–33 *Belemnopsis* cf. *gerardi* (Oppel); Spath, pp. 706–7.
1929 *Belemnopsis gerardi* (Oppel) (*partim*); Stolley, pp. 151–7, pl. 1, figs. 18, 20, 22, 24–29; pl. 2, figs. 1–3 (*non* pl. 1, figs. 16, 17, 19, 21, 23, 30–32).
1931 *Belemnopsis gerardi* (Oppel); Kruizinga, p. 368.
1931 *Belemnopsis gerardi* (Oppel); Wanner, pp. 585–95.
1934 *Belemnopsis gerardi* (Oppel) typ.; *Belemnopsis* aff. *gerardi*; Stolley, pp. 470–86.
1935 *Belemnopsis gerardi* (Oppel); Stolley, pp. 49, 50.
aff. 1939 *Belemnopsis gerardi* (Oppel) (*partim*); Spath, pp. 110–11, pl. 24, figs. 11, 13 (*non* fig. 12).
1945 *Belemnopsis gerardi* (Oppel); Glaessner, pp. 155–6, pl. 6, figs. 8, 9.
1956 *Belemnopsis gerardi* (Oppel); Marks, pp. 199, 200.
ex. gr. 1956 *Belemnopsis gerardi* (Oppel); Wanner, p. 135.
1956 *Belemnopsis gerardi* (Oppel); Arkell, pp. 408, 447.
1957 *Belemnopsis gerardi* (Oppel); Holland *et al.*, pp. 86, 160, 247.
non 1820 *Belemnites canaliculatus* Schlotheim, p. 49.
non 1823 *Belemnites sulcatus* Miller, p. 59, pl. 8, figs. 3–5.
non 1873 *Belemnites gerardi* Oppel; Waagen, pp. 13, 14, pl. 2, fig. 3.
non 1895 *Belemnites gerardi* Oppel; Kilian, p. 673.
non 1914 *Belemnites sp.*, related to *B. gerardi*; Spitz, pp. 222–3, pl. 19, figs. 11, 12.
non 1924 *Belemnites gerardi* Oppel; Broili, pp. 8, 9; pl. 2, fig. 9.
non 1951 *Belemnopsis* cf. *gerardi* (Oppel); Brunnschweiler, p. 8.
non 1958 *Belemnopsis* cf. *gerardi* (Oppel); McWhae *et al.*, p. 90.

Diagnosis. A *Belemnopsis* with a short robust guard, cylindrical or cylindro-conical. Outline and profile symmetrical, both non-hastate. Apex not inflated, usually tapering. Apical, stem, and alveolar cross-sections usually circular. Ventral groove broad and deep,

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EXPLANATION OF PLATE 99

Figs. 1–3, 5. *Belemnopsis uhligi* sp. nov. Holotype. Upper Jurassic (Spiti Shales) of the Niti Pass area, northern India. Accession No. 10161, Geological Survey of India Museum, Calcutta. Original of Uhlig 1903–10, pl. 93, figs. 9*a*, *b*. 1, Ventral view. 2, Dorsal view. 3, Right lateral view (ventral groove facing right). 5, Cross-section at anterior end. All ×1.

Fig. 4. *Belemnopsis uhligi* sp. nov. Upper Jurassic of Kalabagh, Upper Punjab. Accession No. 1872. xv. 46, Schlagintweit Collection, Munich. Original of Oppel 1865, pl. 88, fig. 3. Right lateral view, × 1. See also Plate 98, figs. 9–13.

Figs. 6–9. *Belemnopsis uhligi* sp. nov. Upper Jurassic (Uppermost Fatjet Shales) of Fatjet, Misol Archipelago, Indonesia. Accession No. 116/1, Weber Collection (Locality M.36, see Stolley 1934, p. 484), Naturhistorisches Museum, Basel. 6, Ventral view. 7, Dorsal view. 8, Left lateral view. 9, Right lateral view. All ×1.

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STEVENS, *Belemnopsis*